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BREAKING THE POLICY GRIDLOCK ON GRAZING AND OTHER USES OF PUBLIC LANDS

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THE LOCAL VARIABILITY OF RAINFALL AND ITS INSTITUTIONAL IMPLICATIONS

Summary of Project Outcome

The purpose of this project was to relate one dimension of environmental variability, namely, the local variability of rainfall, to economic behavior and institutional choice. It did so in two quite different contexts, the American West and one country of tropical Africa (Sudan).

While some features of environmental variation, such as the intertemporal variation in rainfall, have received very considerable attention, one feature which has been largely **overlooked is the local variability of rainfall and other** environmental factors. By local variability is meant the extent to which different nearby villages may receive different amounts of rainfall in the same day or month. Recent studies, several of which are reported in the papers done under this IRIS project, have shown that a common characteristic of arid and semi-arid tropical regions (**ASARs**) is the existence of relatively low correlation coefficients among daily (or monthly) rainfall observations taken at relatively nearby locations. Therefore, it is this characteristic of **ASARs** which constitutes the focus of present studies,

The absence of appreciation for the importance of local variability in rainfall and other environmental conditions has led to virtual disregard for the possible benefits of **land-pooling** arrangements in such circumstances. This could mean that the policy recommendations of most economists which are strongly in favor of the establishment of complete private property rights and individual holdings (and thereby against common property rights) as a means of dealing with the perennial threat of desertification and overgrazing in such circumstances, may not be as generally valid as has been assumed to date. By the same token, it could imply that common property, various kinds of land pooling arrangements and institutional mechanisms (**such as** tribes, and the rules established by tribe-like groups) are vastly underappreciated in situations where the local variability of rainfall is important.

The two papers resulting from this project show that local variability is important in the two different regions studied. In each case, the local variability of rainfall has been operationalized by taking advantage of long time series data from rainfall stations in relatively close proximity. The lower the **average rainfall in a given region, the lower tends to be the** correlation (in absolute terms) among daily or monthly rainfall observations from rainfall stations located at given distances from each other. What, then, about the effects of greater local variability of rainfall?

In the American West, it has been found that land pooling arrangements tended to arise sooner and last longer in areas **characterized by high local variability of rainfall** (such as Wyoming and West Texas) than in areas characterized by low local variability of rainfall (such as Iowa). It was also found that such arrangements arose even in areas in which private property rights already existed. This is important because it suggests that the local variability argument for the existence of cattle pools and associations is more appropriate than the traditional one for such relationships, namely, that the emergence of private property rights was impeded by legal constraints on land purchases (or homesteading) of sufficient size as to be **economically viable in the arid American West. According to the** traditional explanation, cattle pools and associations arose as a second best, given the inability to have private property.

In the case of Sudan, it is shown that by the late 19th Century the country's land area had become largely divided up into various "tribal **dars**" within which a particular tribe would have rather exclusive use and each tribe essentially its own **institutions. Moreover, it is shown that (largely as a result of colonial policy) the locations and sizes of these tribal dars** remained largely constant between the late 19th Century and the early 1970s. It was also shown that there existed very considerable variation in environmental conditions (including the **local variability of rainfall) across the various parts of Sudan.** The paper develops specific hypotheses concerning the effects of the local variability of rainfall on specific tribal institutions. To test these hypotheses the paper constructs at least crude measures of (1) a proxy for the relative importance of common as opposed to private property rights and (2) the degree of hierarchy or centralization in the society. For a sample of 41 tribes for which the relevant measures can be constructed, the results show that the various environmental factors influence the relative importance of agriculture **vis-a-vis** animal husbandry and the two measures of tribal institutions identified above. More importantly, the results provide at least preliminary evidence in support of the hypotheses developed, **suggesting in particular that the degree of openness of tribal** lands to all members of the tribe rises with the local variability of rainfall. Finally, although not devoid of simultaneous equation and other biases, efficiency in animal husbandry was shown to be positively related to the degree of openness of tribal lands to all members of the tribe.

Therefore, taken together, the papers provide strong support for the importance of the phenomenon of relatively high local variability of rainfall in two rather different **ASARS** and at **least tentative support for the hypothesized benefits of common** as opposed to private property rights when the local variability of rainfall is relatively high.

BREAKING THE POLICY GRIDLOCK ON GRAZING AND OTHER USES OF PUBLIC LANDS

NICOLAS SANCHEZ and JEFFREY B. NUGENT

This paper provides a simple analytic framework capable of **under-standing** the basis of disputes among stockraisers, environmentalists and other interests over public grazing lands. It uses that framework to derive testable hypotheses. It then goes on to provide empirical evidence in support of both the assumptions and **implications of the framework and to derive implications for policy.** The policy proposals are designed to be politically acceptable and capable of breaking the long-standing gridlock over land policy and of arriving at a more efficient allocation of resources.

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I. INTRODUCTION

Few national economic policies have been mired in policy gridlock as deeply and for as **long** a period of time as the disposal and use of public grazing land. After almost a century of experience showing that land policies adopted in the East did not fit the generally more arid conditions of the American West, the Taylor Grazing Act of 1934 represented a major step in trying to avoid the tragedy of the commons which was occurring in parts of the West. It did so by providing ranchers and other users of public land with more secure use rights and imposing environmental controls.

Yet, many **major difficulties were not resolved by the Taylor Grazing Act**, including how best to protect the environment, how to enforce regulations in a cost-effective manner, how much to charge ranchers for the use of public lands and how to avoid the negative externalities arising from incompatible uses of private and public land in close proximity to one another. As a result, legislative and executive efforts to resolve these problems have continued almost incessantly to the present day. The most recent of such efforts was featured in the **1994 Economic Report of the President** and initiated in March 1994 by Secretary of the Interior Bruce Babbitt (*Congressional Quarterly*, March 19, 1994). Babbitt proposed to (1) double the grazing fee charged for each animal unit month (AUM) on federal land by 1997, (2) impose a tax on those ranchers who sublease their existing grazing rights to others, (3) change the composition of the advisory boards charged with the responsibility of setting policy and settling disputes at the local level, and (4) impose environmental standards **for** care of the ecosystem, streams and their immediate environs, water quality and protection of endangered species' habitat. Yet, once again, the plan resulted in a political impasse and, as of December 21, 1994 the proponents of the plan were "throwing in the towel" (*Congressional Quarterly*, December 21, 1994). Not a single element of the plan was even mentioned in the 1995 **Economic Report of the President**. yet, further attempts to reform the system and resolve the impasse **over** the use of public land are inevitable.

The purpose of this paper is to provide an economic framework for analyzing disputes over the use of grazing land that is sufficiently broad to integrate the interests of both resource users (such as ranchers and miners) and environmentalists, and hence capable of breaking the policy impasse. We begin in Section II with a brief overview of the evolution of land policy, including grazing fees. Section III provides both a simple model for analyzing the issues

involved and empirical support for its assumptions. Section IV derives implications which help explain the incompleteness of the transition to modern farming and ranching in the American West, and the basis for the continuing impasse between grazing and environmental interests. Finally, drawing on both the relevant theory and the historical overview, Section V provides some proposals for how to break the policy gridlock, containing both a set of principles for a better public lands policy and actions on the political economy front to facilitate their realization.

II. AN OVERVIEW OF THE EVOLUTION OF PUBLIC LAND POLICIES

Despite the availability of ~~several~~ excellent surveys on the subject, a brief review of U.S. public land policies of special relevance to this paper cannot be avoided. Following Gardner (1991), the history of public land policy can be divided into three periods: an early period (up to the early 1890s) in which the emphasis was on getting public land into the hands of private owners, an intermediate or transition period (early 1890s-1934), and finally a modern period in which property rights have been frozen more or less as they were in 1934, but with progressively increasing environmental controls on the use of such land.

The Initial (Pre- 1830) Period

During this period, public land policy in the United States was dominated by ~~efforts to~~ transfer public land to states and private owners, subject of course to political constraints (Foss, 1960). While this was easy in the East because of relatively high and rising population densities and land that was generally well-suited to agriculture, it was considerably more difficult in the more arid West. Prior to the Civil War, the most important constraint on land transfer in the West was political (North-South) conflict over the design of institutions affecting the extension of the plantation system, and hence slavery, to other parts of the country. Southern politicians repeatedly blocked homestead legislation fostering transfers of land in small parcels from public to private ownership while Northerners insisted on acreage limitations so as to prevent the extension of plantations.

Moreover, even after homestead legislation was passed during the Civil War, the fear of being tied to corrupt land speculation kept it politically inexpedient to advocate land transfers in large blocs (except in special circumstances, such as in grants to railroads deemed necessary for financing their construction). Hence, homesteads were limited in size to 160 acres, too

small to be economically viable in the semi-arid American West. As a result, much of the land remained in public domain and available for grazing use by bands of cattle and sheep owners. But, with imperfect enforcement of the size limitations, and variability in environmental conditions from one area to another, during the latter part of this period there was considerable intrusion on such grazing land by homestead agriculture and mining (Gates, 1936, 1954 and 1968).

The Transition Period (1890-1934)

The transition was brought on in the late 1880s by technological developments, such as barbed wire fencing, windmills, advances in animal breeding, and railroads, and the growing importance of product quality and hence new breeds (Dale, 1960; Dary, 1981; and Shannon, 1973). These developments fostered (1) agriculture and other more intensive uses of land relative to stockraising, (2) a shift from hardier to less hardy but higher quality breeds of stock, and (3) substitution of private for common property rights and uses. Their effects were further enhanced by two significant policy changes: (1) President Cleveland's decision in the 1880s to prohibit fencing on the public domain, and (2) the Dawes or Allotment Act of 1887 and other elements of Indian policy. The former made it much more difficult for existing users of such land to keep others off (Dale 1960, Savage 1973). The latter forced the Indians to move from more ~~to~~ less desirable regions, thereby opening the way for further migration and homesteading and encouraged reservation lands to be carved up into private allotments, many of which went to non-Indians, and small, independent farms to be formed (Carlson, 1981).

Another feature of the transition was the imposition of permanent federal controls in land use over public lands. Examples include the establishment in 1881 of forest reserves and the transfer of huge areas to such reserves between 1897 and 1924. All such measures consolidated and made permanent the control of such lands by the Forest Service within the Department of Agriculture (Culhane, 1981 and Clawson and Held, 1957).

Yet, millions of acres of (largely grazing) land remained under the control of the Interior Department, still open to homestead and transfer to private parties. Indeed, even in 1900, two-thirds of the acreage in states west of the 100th meridian was still in the public domain. Congress renewed and strengthened its earlier efforts to transfer this land (excluding the forest reserves) to private owners, though still subject to the existing political

constraints. Gradually, the maximum size of homesteads was increased and explicit recognition was given to stockraising as legitimate uses of public lands. As a result, the acreage of annual homestead entries more than doubled after 1900, and homesteading continued unabated until the mid-1920s (Gates, 1968).

Even with considerably larger production units, however, neither stockraising homesteaders nor other stockgrowers with agricultural homesteads in their midst could carry out ranching operations on an efficient scale. One consequence was that "representatives of both the **sheepmen** and cattlemen's associations were certain that the breakup of the range into small stockraising homesteads would damage its carrying capacity" (Gates, 1968, p.519).

Another consequence **was a large discrepancy in acreage between the** original entries under the Stockraising Homestead Act (43 million acres) and those entries completed by 1926 (18.9 million acres) (Statistical **Abstract of the United States**, 1919, 1926 and **1929**), implying widespread abandonment of initial homesteads. By 1921, even the Interior Secretary himself had to admit that "homesteads for stockraising are rapidly reverting to the open range" (Gates, 1968, p. 521). The problem was especially severe in the Mountain states and some Indian reservations where agricultural homesteads on the better lands were somewhat more viable and yet their presence reduced the effectiveness of adjacent public and Indian rangelands. Again, as noted by Gates (1968, p. **522**):

"By 1923 Henry Wallace, Secretary of Agriculture, was taking a strong line about the 'reckless breakup of the range' by homesteaders who were encouraged to proceed upon the land without consideration of the economic and social waste they would cause. Sixty years of experience in the use of the public rangelands had shown that, except for such portions as could be irrigated, none were suitable for farming."

Even worse, as agricultural homesteads were abandoned and stockgrowers allowed their stock to feed on them, but without guarantees of long-term use of such land, the stockgrowers had the incentive to overuse these lands, thereby creating the familiar tragedy-of-the-commons. Meanwhile, however, on the forest reserves, where **agriculture** was not permitted and entry was restricted, the Forest Service successfully leased land to stockgrowers during the summer months in exchange for grazing fees (Robinson, 1975).

The first breakthrough in the management of range land controlled by the Interior Department, and where (as documented by Gates, 1968, pp. **608-9**) the commons problem was much in evidence, came in Montana. In 1926 a stockman, a

railroad agent, and a county extension agent organized a cooperative association to regulate use on, and consolidate the management of, land in an area (bordered by the Mizpah and Pumpkin Creeks) in that state which was characterized by varying ownership and land use arrangements. Their plan, sanctioned by a special act of Congress in 1928, pooled all the lands in the region, regardless of their ownership, and arranged that management and range improvement services be provided by a governing association of users. Somewhat similar experiments were carried out on Indian reservations by perceptive reservation administrators (Carlson, 1981; Getty, 1961-62).

The Mizpah-Pumpkin Creek experiment resulted in an increase in the forage value of the land of no less than 38% and gave rise to similar experiments elsewhere in the West and ultimately to the Taylor-Grazing Act of 1934 (Gates, 1968). Almost simultaneously, the Indian Reorganization Act of 1934 ended allotment on Indian reservations, leaving a complicated patchwork of different land tenure on reservations (Anderson and Lueck, 1992) but also beginning a process which accelerated in the 1970s of returning integrity and control to the Indians themselves.

The Modern Period

The Taylor Grazing Act led to the establishment of grazing districts on lands controlled by the Interior Department. Because much was left to the management of the individual grazing districts, which naturally varied in quality from place to place, generalization is difficult. Yet, overall, the experience seems to have been favorable (Thompson, 1951; Clawson and Held, 1957; Foss, 1960; and Culhane, 1981). By increasing the forage value of the land, the tax base of the local economy was increased, thereby improving the economic health of surrounding communities. Notably, once the Taylor Grazing Act had been approved, confidence (not fully warranted) that efficient use of public lands had been restored, led to the withdrawal of most such lands (except in Alaska and Washington) from homesteading, effectively placing them under permanent federal control (Culhane, 1981).

Three aspects of the Taylor Grazing Act deserve special attention. First, stockowners gained grazing permits on federal lands by controlling, through lease or purchase, other nearby lands. In other words, grazing permits on federal lands became tied to other (nearby) lands (not individuals). Second, the federal land allotted to grazing permittees could be used either in individual

private lots or in common. Third, the grazing districts were administered by federal officials in consultation with stockowner-dominated advisory boards.

Claims have been made (e.g., Libecap 1981, 1989) that the Interior Department supported the Taylor Grazing Act to further its own revenue-maximizing interests, suggesting that stockgrowers would have been much better off if the public domain had been transferred to private interests in fee simple. Yet, such claims ignore the problems that led to the creation of the grazing districts and fail to explain why land transfers were generally successful in the Great Plains but not in the Mountain states (to which we return in Section IV). In effect, they insufficiently take into account (1) the external diseconomies created by the splintered system of property rights in land (Parr et al., 1928 and Gates, 1968), (2) the ecological constraints facing stockowners (discussed in Section III), and (3) the relative success of the Forest Service (prior to the Taylor Grazing Act) in improving grazing land (Robinson, 1975 and Gardner, 1991).

Over time, the holders of grazing permits have strengthened their rights to federal land under their control (Clawson, 1983; Gates, 1968 and Hage, 1990). For example, grazing permits may be confiscated only for cause, such as non-use over several years or demonstrated overuse; the Internal Revenue Service considers the permits private property in calculating the value of estates; even the military must enter civil condemnation proceedings in open court to gain control over the federal lands allotted to permit holders; and federal range rights cannot be purchased from the government but only from ranchers controlling them through base property holdings.

Yet, the federal government retains three important rights over the "split estate" of federal grazing lands. It may (1) limit the total number of animals that can be grazed on any given range, (2) charge grazing fees, and (3) allow other potential users of such lands to exploit them. Unless control should pass to boards dominated by non-stockgrowers (as threatened in 1994), right (1) should pose little threat to stockgrowers since it is in the self-interest of user-dominated local advisory boards to limit the numbers of animals on these federal lands. Right (2) has led to numerous and continuing disputes, but ones which are primarily redistributive in character. In particular, since the fees generate funds for capital improvements within the districts and budgetary support to local governments in surrounding communities, the higher are such fees, the lower the need for government subsidies of such services. Thus, lower

fees but higher federal subsidies to the necessary services would make the members of grazing districts better off but taxpayers worse off. A sufficiently large increase in grazing fees, however, would cause stockowners to decrease their use of grazing permits and could be considered a "taking" of their existing property rights. While right (3) raises similar considerations as in (2), it requires a broader discussion of technology and resource allocation as in Section III.

Grazing Fee Controversies

Although it was apparently the original intent of the Taylor Grazing Act for the grazing fees to cover the administrative costs of the grazing districts, fee levels were set in 1936 and remained until 1947 at five cents per animal unit month (AUM), a rate insufficient to cover administrative costs. Although during this period the Grazing Service at Interior tried repeatedly to raise the fee so as to account for the increasing value of forage, the political power of the stockowners was sufficient to defeat such attempts. Indeed, their power was sufficiently great that after one such threat to raise fees, the Grazing Service budget was cut in half, forcing the agency to disappear as a separate unit, thereafter becoming part of the Bureau of Land Management (BLM) (Foss, 1960 and Gates, 1968).

If grazing districts had played no positive economic role, in the absence of federal manpower to support their services, one would have expected their demise at that time (1947). Yet, the local boards came to their immediate rescue by raising funds to help pay the salaries of employees. Subsequently, with grazing fees on national forest land (carefully controlled by the Forest Service) 3-5 times as high as those in effect on BLM lands, the local boards and the stockraisers behind them subsequently allowed grazing fees to be raised to 8 cents per AUM as an alternative way of fostering the work of the local boards (Foss, 1960, p. 187).

In more recent years grazing fees have been based on increasingly complex formula so as to reflect varying conditions from place to place. In the 1950s, the formula took into account variations in the market prices of cattle and sheep and in the late 1960s to consider also land rental rates, and the present formula (in effect since 1978) and takes into account also the market prices of grass, meat, and stockowner inputs (Obermiller, 1991).

Given that private rental rates typically exceed the federal fees by a considerable margin, one could suppose that this differential would distort the

allocation of resources. While this may well be true, the following considerations of public lands relative to private ones could decrease and perhaps even eliminate that margin: lower nutritional value of the forage, more costly access, greater mortality rates-, the need to incur the costs of veterinary services and depreciation on capital improvements (Hage, 1990; Gardner, 1991 and Obermiller, 1991).

Even if the private-public grazing fee differentials were substantial, since the lower cost of federal land would be capitalized into the selling price of private ranches with access to federal land, it would not imply that-the current owners of these ranches (seldom still the original owners) are subsidized.

III. RELEVANT PRODUCTIVE TECHNOLOGIES AND THEIR IMPLICATIONS

The present section provides a conceptual framework for the policy proposals given below, based on the productive technologies characterizing the most relevant uses of public land in the aforementioned semi-arid American West, namely animal grazing and wildlife habitat. In reality, of course, there are other relevant uses, such as hunting, other forms of recreation, mining and manufacturing, and even within any one such use, there are major differences.

Animal Grazing

In the conditions of the pre-transition American West, i.e., low population density, abundant grasslands, and the absence of **cheap** fencing, low cost transportation networks, and law and order and vulnerability of economic activity to **severe** fluctuations in weather, it is not surprising that the early settlers of the Great Plains and Mountain region (1) turned to animal husbandry rather than to agriculture as their main commercial activity (Dale, 1960; Sanchez and Nugent 1994), (2) concentrated on very sturdy, disease-resistant animal breeds, like longhorns in cattle- and mixed breeds in sheep, and (3) used land-intensive (land being cheap), other (more expensive) input-extensive technologies.

An even more important characteristic of such technologies, however, is economies of scale. Not only are there economies of scale with respect to animal supervision (Dennen, 1976; Libecap, 1981), but under conditions of **substantial** variability of rainfall (characteristic of these and other semi-arid lands) in which animal survival probabilities are increased by the freedom to search for fresh water and pasture over the largest possible area, there are also substantial economies of scale with respect to reducing the risk of animal

mortality (Osgood, 1929; Thompson and Wilson, 1994; Nugent and Sanchez, 1993), preventing and detecting theft, protecting against animal diseases and attack by predators, and in transportation.

How large were (are) these scale economies altogether? For cattle in 1880 Wyoming, Eaton (1981, p.190) estimated the average cost (per head) of raising a steer from yearling stage to market age to be about \$14 in a herd size of less than 1000, \$4.80 in a herd of 1000, and \$1.05 in a herd of 15,000. Somewhat similar estimates for sheep are also available and from contemporary accounts. As a result, the grazing districts of contemporary semi-arid American West range in size up to 11 million acres (Calef, 1960, p. 80, 157). Indeed, one stockraisers association is said to control and manage rather effectively a solid block of 1.9 million acres. To put this in perspective, consider that even yellowstone National Park as a whole is only 2.2 million acres.

Wildlife Habitat

Although there are numerous forms of wildlife, each with very different characteristics and habitat requirements, for present purposes attention is confined to large carnivores like wolves, grizzly bears and mountain lions and large herbivores such as deer and elk. Within this set at least, there is common agreement among biologists, about the technical requirements for reproduction and survival (Primack, 1993).

First, because of the importance of habitat to the survival of such wildlife, interdependencies among the species inhabiting such habitats, and the limited flexibility of such habitat requirements, virtually every form of wildlife has its own (often rather exacting) habitat requirements.

Second, because of the incompatibility of different habitats and of the species which live in them with each other, for many species another crucial requirement is that each species has a large "core area" from which man and domesticated animals are excluded. A corollary is that fragmentation of a core area undermines the efficiency of production and thereby significantly increases the total size of the area required for survival (Wallis de Vries, 1995).

Third, because of the large appetites of large carnivores and herbivores, and the threat to sustenance of their habitat that intensive use of that habitat may imply, the land requirement for each member of any such species may be extremely large- For example, the Fish and Wildlife Service has estimated that 76 square kilometers of roadless land are required to maintain one grizzly bear in the wild (Mann and Plummer, 1993).

Fourth, because of the genetic degeneration that follows from in-breeding among small numbers of a species, the weather and disease risks that arise from overcrowding, mobility and inter-species contamination, and the chances of adverse sex selection (such as all offspring turning out to be males), the minimum number of members of a sustainable species must be rather large (several thousand). Fifth, because of various environmental and in-breeding risks, there is a need for multiple core areas and corridors connecting them. Sixth, both the corridors and the core areas, moreover, should not have abrupt "edges", but rather need to be protected by buffer zones in which penetration by other species is much restricted (Soule and Wilcox, 1980; Mann and Plummer, 1993; Primack, 1993).

All these requirements combine to make the size of an area required for species survival extremely large. For example, some estimates suggest that up to a million square kilometers (i.e., about the size of California, Nevada and Oregon combined) may be required to sustain a single species of large carnivores. Clearly, by these standards, environmental biologists conclude that even the most ambitious of actual or planned species **reserve** programs are woefully inadequate for long-term survival of the species (Mann and Plummer, 1993; Wallis De Vries, 1995).

Among existing reserves and national parks, those in the American West are among the largest. Yet, even in such parks the set of animals under protection is much narrower than those which originally lived in such areas, and is likely to dwindle further because the numbers of several such species are too small to be sustainable (Chase, 1987). The legislative response to this experience has been laws setting aside ever larger blocs of additional land for wildlife reserves, and reducing human presence in them to a minimum (e.g., for fire protection only).

Similarly, logging, which requires the construction of roads, landings and other facilities which alter the structure of any forest, can have serious adverse effects on the survival of various animal species. So too, the browsing habits of cattle and other domestic animals can affect plant habitat in a way that is non-optimal for game animals (Gardner, 1991). In effect, today's introduction of logging into a forest or cattle into a game reserve can have **effects which are just as deleterious on stockraising as the introduction over a century ago of agriculture in close proximity to animal husbandry.**

While there are certainly cases in which the negative externalities between different activities in the same area may be only minor, as in the case of wild herbivores and domesticated ones such as cattle or sheep where the different species merely compete for grass, the generality and extent of negative externalities should not be underestimated. Wolves and coyotes kill sheep; mountain lions may kill sheep and cattle; even small wildlife like squirrels and prairie dogs carry diseases deadly to cattle and sheep. Moreover, recreational uses like hunting are often incompatible with species preservation and biodiversity. Hence, just as with stockraising, it is this combination of (1) **economies of scale in production of the relevant activities** and (2) **negative externalities between them which make it most undesirable to undertake other incompatible activities in close proximity.**

A major difference **between stockraising and wildlife habitat** is in ownership regimes. Even when cattle are allowed to intermingle, individuals or corporations claim ownership over specific animals. By contrast at present, the ownership rights over wildlife are often conflicting and poorly defined (Harrington, 1991 and, in the case of game animals, Lueck, 1991). As a result, the federal government has taken primary responsibility for wildlife production and protection, but thereby making it difficult for those most concerned about wildlife to be closely involved in their management.

A Model and Illustrations of its Applicability

The preceding discussion demonstrates that the semi-arid areas of the American West were and still are suitable for both stockraising and wildlife production. Indeed, since historically it was cattle which took over the ecological niche once occupied by buffalo and other wild ungulates, this should not be surprising. Both are subject to economies of scale and, with some exceptions at least, the production of both in the same area is generally incompatible.

This implies that the aggregate production frontier for the region would not resemble the standard one (convex to the origin) but rather the ones shown in Figure 1. From such a diagram, it is clear that corner solutions will be optimal, the choice among them depending on both (1) the implicit price between "cattle" (a proxy for stockraising in general) and "wildlife" and (2) the relative productivities of land in the specific regions A and B for production of each. In the absence of a well-defined market (reflected in a straight-line price line) between cattle and wildlife, however, an unambiguously efficient

choice between such corner solutions cannot be made without appropriate intervention.

While the model fits well the aforementioned descriptions of technology, it is rather different from existing analyses of the production functions and interdependencies between wildlife and other activities. For example, **Lueck (1991)**, in his interesting analysis of wildlife and agriculture, uses the fact that the optimal size for wildlife production (for him mainly game animals) may exceed that of the average farm to explain (on the basis of the transaction costs needed to contract between the different owners of farms on which the wildlife live part of the time) why private ownership of wildlife is limited. The numbers he uses for minimum efficient sizes of farms and wildlife reserves, **however, are only tiny fractions of those estimated by professional biologists.** While there may be base ranch properties and farms adjacent to river basins which are relatively small in parts of the American West, the existence of game animals on such farms and ranches depends on nearby forest reserves and protected grazing districts of vast size.

Although useful for generating testable implications for the way in which access to game animals is organized, Lueck's analysis does not address the concerns of environmental groups or the topic of this paper, namely the basic conflict between stockraising and habitat preservation. One such area of **conflict** was the **swampland** covering some 3000 square miles in **Northwestern** Indiana and Northeastern Illinois known as the Great Kankakee Swamp. One hundred years ago the area **was** entirely wetlands. Having since been drained, however, now it consists entirely of **cropland** and pastures. The two uses proved incompatible and the wetlands were converted to agriculture, hence from one corner solution to another (**Mitsch** and Gosselink, 1986).

In light of the importance of entire habitats to productive efficiency and economies of scale, one can easily understand why attempts to preserve habitats and wildlife have usually been large-scale. For example! the Antarctic Treaty of 1961 represents an attempt by the community of nations to preserve the natural habitat of that entire continent.

In the context **of** the American West, the preservation of wildlife has been an objective of virtually every significant piece of land legislation since 1960 (Graf, 1990). Among these have been (1) the Multiple-Use Sustained Yield Act of 1960 (which gave wildlife protection a priority equal to that of other uses of public land); (2) the Wilderness Act of 1964 (which imposed on the Forest

Service "a duty to study areas within the forests that still retained wilderness qualities and turned over to Congress the right to designate official wilderness [areas]" (Sax, 1989, p. 120)); (3) the Federal Land Management Act of 1976 (which mandated an integrated interdisciplinary approach to land management and priority to the setting out of wilderness areas and a scheme for their management (Sax, 1989, P. 123); and (4) the Endangered Species Acts of 1966, 1969 and 1973 (which mandated that species (even merely local ones) should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part (Gregg, 1989).

IV. APPLICATIONS: INCOMPLETE TRANSITION AND CONTEMPORARY CONFLICTS

After the transition-inducing changes identified in Section II were felt, a transition to private farms and ranches with new breeds and crops and modern technology would have been expected throughout the West. Yet, as noted above, that transition was largely limited to the Northern Plains states (Nebraska, North Dakota and South Dakota). Significantly, it was not achieved in the intermountain regions of the Mountain states (i.e., Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada). This is demonstrated in Table 1 by the fact that, despite the general applicability of the technological developments which began as early as the 1880s and the considerable efforts of the federal government to dispose of all unappropriated and reserved public lands especially after 1900, by 1944 in none of the Mountain states had the percentage of land remaining in government ownership fallen below 35% whereas in **none** of the Northern Plains states had it not fallen below 20%.

Why was the transition achieved in the Northern Plains states but generally not in the Mountain states? The above analysis suggests that the relevance of differences in population density and ecological conditions (rainfall). The latter could be measured by the ability to grow crops, and especially those crops like hay that could be stored for use as fodder, thereby permitting a more intensive use of the land, either agriculture or modern animal husbandry.

For evidence on the applicability of these factors, turn first to the population densities of Table 2. While these increased substantially in both sets of states between 1900 and 1930, with the single exception of Colorado, even in the latter year they remained considerably lower in the Mountain states than in the Northern Plains states. The higher population density of Colorado,

moreover, was due in part to the concentration of population in the greater Denver area which is not part of the intermountain region.

As to agricultural potential and the ability to grow hay and other animal feed, Tables 3 and 4 make it clear that the Northern Plains states had considerably greater potential in both respects than the Mountain states, though once again with the partial exception of Colorado.

Another implication of the model is that substantial cooperation would be required by different animal or wildlife owners in any given region to take advantage of the aforementioned economies of scale within any single activity, overcome the disincentive⁵ on production where positive externalities are generated and to avoid the negative externalities which would arise when the different activities are located in close proximity to one another. For example the efforts by one stockowner to protect his animals from theft, predators or poisonous plants could create important positive externalities for the animals of his neighbors. Likewise, the existence of nearby agricultural fields unprotected by fences would impose serious negative externalities on stockraisers who would have to either prevent their animals from destroying valuable crops or risk loss of their trespassing animals (Rollins, 1979).

The fact that very distinctive institutions arose early in the American West is very consistent with the model. Among these institutions were animal pools, stockgrower organizations and the many activities such as round-ups, mutual protection and detective bureaus, and collectively supplied transportation and veterinary services (Osgood, 1929; Webb, 1931; Pelzer, 1936; Dale, 1960; Anderson and Hill, 1979).

As noted above, these institutions had their heyday prior to the transition-inducing introduction of barb-wire fences, windmills, new animal breeds, and dry farming techniques at the end of the Nineteenth Century (Cochrane, 1993 and Sanchez and Nugent, 1994). Yet, instead of disappearing everywhere after that, many of the same institutions have remained in some parts of the region, even if in somewhat different form.

For example, where conditions remain similar to what they were earlier and rather "primitive", as they do in the Mountain states, it can be seen that today's grazing districts of the region perform the same coordinating and efficiency-enhancing functions as the cattle pools and associations of the early period. That is, as demonstrated by Calef (1960) for the mid-Rocky Mountain Basin, these different institutions serve essentially the same functions.

While there has not yet been any large-scale conversion of grazing land to wilderness, progressively greater priority than in the past is being given to wildlife and entire habitats. Also, since the choice between wildlife and habitat on the one hand and domestic animals on the other is basically a dichotomous one, the conflict over that choice, so evident in Secretary Babbitt's proposals of 1994, is responsible for the stalemate over land policy which has existed since the 1930s.

To a degree, the conflict between stockraisers and wildlife interests can be minimized by complementarities which may exist between cattle and some wild animals. one basis for such **complementarity** is the opening up and subsequent maintenance by stockowners'of water holes (which can also be used by wild animals). **Another** may be deliberately **promoting in close proximity those** particular species of wildlife and domesticated animals whose uses are at least compatible, and perhaps even complementary as in the case of bees and apple trees. Yet, as suggested above, at present, such complementarities and compatibilities seem vastly outweighed by negative externalities. For example, if major predators of domestic animals were allowed into the environment as part of a policy to return it to a pre-existing habitat, their presence could have **extremely** disruptive effects on stockraising.

While reference has been made to disputes over animal grazing fees on public lands, it should **be clear that such disputes are but a cover for the more** important one over the optimal use of public lands. While efficiency may require optimal prices or fees, the aforementioned limitations on comparability between **private** and public land, the absence of adequate information on the elasticities of demand for public grazing land (Johnson and Watts, 1989; Watts, 1994) and the presence of distortions in other prices such as the absence of user fees for wildlife or recreation (Anderson, 1994) suggest both (1) that it may be extremely hard to get the fees right and (2) that getting only the grazing fees right may well be insufficient. Moreover, in the long run the optimal uses of government land in the region may involve activities not even being considered at present (such as manufacturing centers and retirement communities fueled by solar energy, and decentralized computer networking and distribution centers which in the age of the telecommunications superhighway would no longer be discouraged by the high cost of conventional forms of transport and communication). Such uses should not be locked out as they increasingly seem to be in recent legislation.

This basic conflict over public land use, moreover, is abetted by conflicting ideological positions. Some advocate selling off the public domain and permitting markets to allocate them across competing uses; others fear the market and view federal agencies as the last hope for preserving our common inheritance.

It should be clear that the authors part company with both extremes. On the one hand, the market for wildlife hardly exists and because of economies of scale in most relevant activities, the conditions for efficient and competitive market solutions are clearly violated. On the other hand, because of the possibilities for rent-seeking and that serious mistakes may be made even by well-intentioned government officials, it is far from clear that, unless at least indirectly guided by market forces, civil servants will do any better than the unfettered market.

What is clear, however, is that public sentiment towards wildlife preservation is increasing, adding strength to the continuing trend toward setting aside large tracts of land. Indeed, it would appear that the federal lock over public lands is stronger than ever. While government agencies are perhaps playing a useful mediating role between wildlife groups and stockraisers, they are at the same time also excluding other potential users of these lands. Yet, unless these other potential users have a chance to compete for the public lands, efficiency in allocation cannot be assured. This requires an alternative institutional structure, to which we now turn.

V. SOME PROPOSALS FOR BREAKING THE POLICY GRIDLOCK'

Above all **else**, the preceding analysis has highlighted the following findings: (1) the existence of important (and much **under-** appreciated) economies of scale in the activities which would seem to be most appropriate for the arid and semi-arid areas which comprise much of the Mountain states of the United States, (2) that economies of scale and negative externalities are behind the major conflicts which exist between stockraisers, environmentalists and others over land policies, and (3) that uncertainty with respect to the outcome of this conflict, by undermining property rights, has the potential for making things considerably worse in the future for all parties to the conflict.

Given the depth and breadth of the problem and changes needed, we begin by establishing some general objectives for, or principles of, a more ideal system:

(1) Zoning. As long as economies of scale are important in the principal contending activities in the Mountain states, and a market for wildlife doesn't

exist, zoning must be practiced. By this we mean that the land use in any given zone would be restricted for the most part to the primary activity chosen by the zoning authority of that zone. Other activities would be permitted only if they were compatible with the primary activity, and subject to rules and regulations laid down by that authority. It is this principle which most sharply distinguishes our proposal from simple ones in which other parties are given the right to buy out the holders of grazing permits.

(2) Increasing the Competition among Alternative Uses. The present system of public land use is inherently inefficient precisely because use is restricted to present and past uses (grazing, wildlife, logging and recreation). To assure efficient allocation, the competition for the right to use public land should be as open as possible, not restricted to the above uses as it has been since the 1930s.

(3) De-Regulating. With large zones and strict zoning within them, all activities within a given zone would be mutually compatible, thereby minimizing any negative externalities emanating from activities within the zone, and greatly reducing the need for costly regulation by government. Considering the current trend toward higher and more costly regulation of grazing activities, such as posting federal employees on every stream or river to see to it that the livestock do not damage the rivers and streams they cross (and the fish species living in them), the savings in social costs of changing the regulatory regime could be rather large. To keep transactions costs low, emphasis should be placed on self-regulation and property rights.

(4) Strengthening Private Property Rights. By sharply increasing fees, changing the character of advisory boards and imposing increasingly burdensome regulation on grazing lands, the recent initiatives of Secretary Babbitt threatened to undermine the rights of existing users of the public lands. In the long run, the result of doing so can only be to reduce both the incentives for such users to invest in that land and the realization of economies of scale. Instead, the property rights of land users should be strengthened rather than weakened. Given the presently divided state of these rights, their strengthening implies making them both more complete and better coordinated, though not necessarily implying that there be a single owner. Calef (1960), for example, shows that grazing districts succeeded in achieving coordination in land use under a wide variety of institutional arrangements, ranging from ownership by a single corporation to cooperatives of many small owners guided by an overall

coordinating committee. Complete property rights must include the right to sell land and other associated rights and the value of such rights can be strengthened by the development of open markets of this sort, though subject to the zoning constraint. This calls for a complete and detailed set of rules concerning how this might be done, how much and how landowners should be compensated for giving up their preference to undertake an activity deemed inconsistent with the collectively chosen one(s). While doing so is well beyond the scope of this paper, some tentative guidelines are given below.

(5) Encouraging Multiple but Compatible Uses Within a Given Zone. While the productive technologies of the principal activities of the Mountain states are characterized by economies of scale, thereby making zoning important, there may yet be considerable scope for accomplishing the multiple use of land in a given region so long advocated by Clawson (1983) and other managers of public lands. Accomplishing this, however, may better be left to private entrepreneurs than to government officials.

(6) Controlling the Zoning Authority. As in other reforms, effective means of regulating the regulator and lowering the transactions costs of reaching collective decisions must be identified. This implies that the procedures used must be respected as legitimate and hence easily enforceable. To that end the members of each zone, themselves, should decide on how to organize themselves, e.g., as a single corporation, a cooperative, or an association of individual owners, and to write their own constitution. As with any well-functioning constitution, the rules adopted should be both sufficiently stable as to induce commonly shared expectations and sufficiently flexible to allow for changes in land use if such changes should be beneficial to the group as a whole. To reduce the threat that the best interests of the majority would be thwarted by a stubborn holdout, a majority or two-thirds voting rule among association members would be preferable to a unanimity rule. Zone members should also identify how and by whom disputes should be resolved.

(7) Delivering Services by User Groups Themselves. In view of existing evidence that the services provided by government to recreationalists, sportsmen, ranchers and lumber companies are inefficiently supplied (Anderson, 1994; Chase, 1987; Anderson and Hill, 1994), it is very important that these different user groups design, manage and monitor such services themselves. While user groups are of course not immune from the same problems as government, much has recently been learned about the conditions for their success (Wade, 1988;

Ostrom, 1990, 1992). User groups, moreover, have distinct advantages over government with respect to the incentive to develop effective monitoring and evaluation methods and the ability to monitor and evaluate at much lower cost.

Some Proposals for Realizing These Objectives

With these principles or objectives in mind, we offer the following more specific suggestions as to how to move towards their realization. Because Congress has gained control over wildlife protection (Harrington, 1991), it is clearly the federal government which would have to take the lead in implementation, though with the cooperation of state and local government and grazing and other interests. The first and most basic component of the reform process is to institute zoning in large blocs. Where they already exist and are well-established and well-functioning, the zones might be based upon existing grazing districts or wildlife reserves. In other cases, the zones should be based on newly established or reformed grazing districts or wildlife reserves. Each zone should be large enough to take advantage of economies of scale but not so large as to make the transactions costs in decision making and self-monitoring prohibitively high.

Second, the fragmented system of property rights in grazing land should be consolidated and made more complete by selling off those rights remaining in government hands to the highest bidder. Each such sale would be subject to the constraint that land use would have to comply with that of other land in the same zone. Although the price of such residual rights would be determined by competitive bidding, if the winning bidder were the party currently possessing lease rights to such land, that party should be compensated for the pre-reform appraised value of the existing right. Hence, for such a party the effective price would be lower than for a party not possessing such lease rights. However, since the proposed reforms should remove uncertainty with respect to future use, regulations and grazing fees, and increase the efficiency of operations through the zoning principle, there should be a considerable gap between the pre-reform value of their existing use rights, and the post-reform values of their more complete rights which would be reflected in the bidding. Appropriate compensation would be based on pre-reform values, implying that compensation would be considerably less than full.

Even so, such compensation might be seen to favor unfairly incumbent users of such land. yet, it should be clear that any hint at compensation below this would (1) undermine the value of existing property rights, (2) ignore the fact

that such users presently pay (to local governments) taxes for the value (to them) of such leases and (3) further complicate the realization of mutually compatible uses within such zones. Nevertheless, though subject to the zoning constraint and the aforementioned compensation, the bidding competition for such land should be as open as possible, and hence confined neither to grazing uses, nor even to the recreational, wildlife and other uses designated in all amendments to the Taylor Grazing Act. Indeed, suggestions are given below as to how recreationalists and environmentalists may be assisted in their bidding efforts.

The above reforms would have a good chance of implementation only if they would have the support of the major contenders in public land use disputes. In view of the above proposals for partial compensation, strengthening existing property rights, and efficiency-increasing deregulation, grazing interests would likely support them. Indeed, in some respects the proposed reforms are similar to ones proposed by stockowners themselves (Hage, 1990).

In view of the civil servants* interest in maintaining the present system, however, it is doubtful that they would warmly receive the proposed reforms. Yet, some civil servants might favor such reforms since the federal funds generated by the sale of property rights could relax the budget constraints on the creation of other public sector jobs for them. More importantly, the comparative experience reviewed above (wherein agency employees succeeded in blocking privatizing reforms in the Mountain states where the benefits of such reforms were rather low, but not in the Northern Plain states where these benefits were large) suggests civil servant opposition can be overcome if the benefits of change are as large as they would seem to be now.

Gaining support for our reforms from environmentalists and wildlife groups could be more problematic. As Anderson (1994) points out, environmentalists presently manage to raise very substantial funds. Yet, free-rider problems may still prevent them from competing effectively with existing ranching corporations and grazing associations in bidding for large chunks of the public domain and adjacent private land. Quite conceivably, however, such organizations could be convinced to accept the reforms if their financial capabilities could be strengthened sufficiently to make them effective competitors.

How might this be done? We believe it could be done without compromising the other efficiency-increasing principles identified above, by one or both of the following actions: (1) by adding a checkoff on individual tax returns to

allow individuals to contribute to one of several such designated organizations in lieu of a certain portion of their federal taxes, and (2) by allocating directly to such organizations a designated share of the proceeds of the sales of the federal government's residual land rights. Since as suggested above, in view of the efficiency gains that the reforms should generate and compensation would be only partial, these proceeds of the sale of these residual rights as part of the overall reforms could be very substantial indeed. As potential property owners, such organizations would have every incentive to bid efficiently and, on becoming the property owners of any zone, (a) to allocate such land efficiently across alternative uses and, (b) within uses, to choose efficiently among alternative technologies.

The final policy issue to be addressed is the longer term one of knowing when to end large-bloc zoning. As long as the competing uses involve technologies with increasing returns to scale, such zoning should not be terminated. Yet, in the long run, alternative uses of land in the Mountain states could arise which do not involve economies of scale. For example, new minerals or improved techniques for extracting underground water for crop irrigation might be discovered, or solar technology might become sufficiently economic to attract industry to the region. At such point, large-bloc zoning would become redundant and indeed could even become an obstacle to efficiency. To avoid that, the new potential users should have to buy out the zoning authority to either re-zone or drop the zoning requirements. To do this, however, the support of more than a simple majority, but again less than unanimity, of association members within a zone should be required. In this way, the competition for land use would be made more complete and be exercised through transactions in the land market. Indeed, the competition among stockowners, environmentalists, wildlife and other interests in land transactions would constitute the efficiency-improving counterpart to the tradable emission permits in pollution control.

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TABLE 1. UNAPPROPRIATED AND UNRESERVED LANDS, 1900, 1930, 1940, AND PERCENT OF THE LAND OWNED BY THE FEDERAL GOVERNMENT.

	Unappropriated and Unreserved lands (in millions of acres)			% of land owned by the fed. government.
	1900	1930	1940	1944
<u>Northern Plains States</u>				
Nebraska	9.79	0.02	0.02	1%
N. Dakota	18.72	0.14	0.10	6%
S. Dakota	11.93	0.43	0.27	18%
Totals	40.44	0.59	0.39	
<u>Mountain States</u>				
Montana	67.96	6.60	6.45	35%
Idaho	43.28	10.61	11.87	64%
Wyoming	48.35	15.92	15.90	51%
Colorado	33.65	8.02	7.93	38%
New Mexico	56.54	15.66	15.69	44%
Arizona	50.28	15.18	13.86	73%
Utah	42.96	23.88	25.73	72%
Nevada	61.27	51.45	51.14	87%
Totals	410.29	147.32	148.57	

Source: Statistical Abstract of the United States, 1946

TABLE 2. POPULATION DENSITY PER SQUARE MILE.

	1900	1930
<u>Northern Plains States</u>		
Nebraska	13.9	17.9
North Dakota	4.5	9.7
South Dakota	5.2	9.0
<u>Mountain States</u>		
Montana	1.7	3.7
Idaho	1.9	5.3
Wyoming	.9	2.3
Colorado	5.2	10.0
New Mexico	1.6	3.5
Arizona	1.1	3.8
Utah	3.4	6.2
Nevada	.4	.a

Source: Statistical Abstract of the United States, 1932.

TABLE 3. PRODUCTION OF HAY,

	ALL HAY CROPS	TAME HAY	WILD HAY
	1899	1919	1930
	(1,000 tons)	(1,000 tons)	
<u>Northern Plains States</u>			
Nebraska	3,517	6,619	2,867
North Dakota	1,748	3,765	1,084
South Dakota	2,383	-4,997	1,076
Totals	7,648	15,381	5,027
<u>Mountain States</u>			
Montana	1,059	1,383	1,726
Idaho	899	2,331	2,489
Wyoming	462	907	936
Colorado	1,647	3,580	2,215
New Mexico	196	694	321
Arizona	177	495	332
Utah	851	1,032	1,295
Nevada	419	548	448
Totals	5,710	10,970	9,762

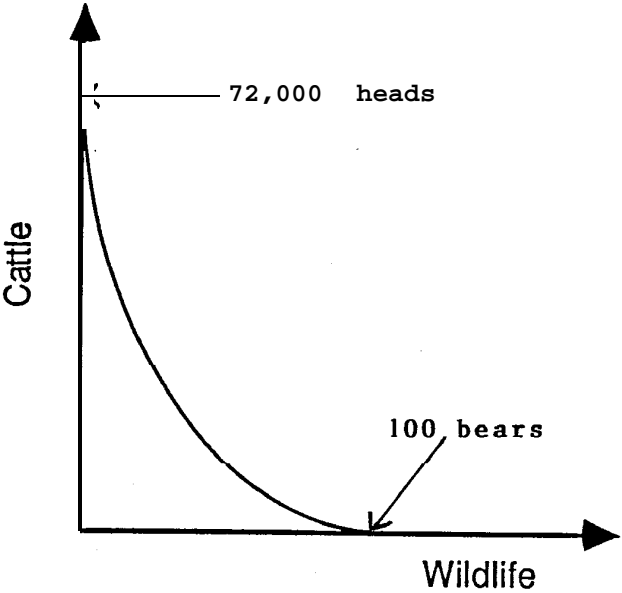
Sources: U.S. Department of Agriculture (1900) and Statistical Abstract of the United States, 1920 and 1932.

TABLE 4. PRODUCTION OF FEED CROPS.

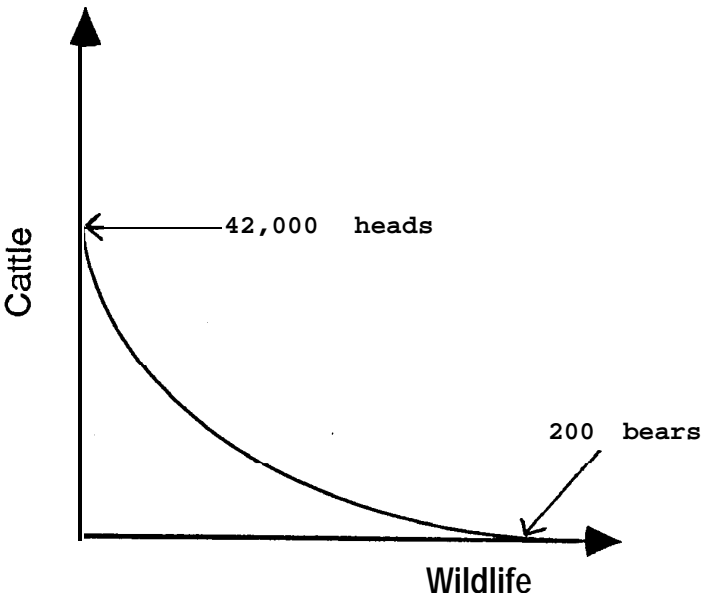
	CORN		OATS		BARLEY	
	1899	1930	1899	1930	1899	1930
	(1000 bushels)		(1000 bushels)		(1000 bushels)	
Northern Plains States						
Nebraska	210,974	239,100	4,746	72,065	2,034	18,876
N. Dakota	1,284	18,112	22,125	40,194	6,752	43,996
S. Dakota	32,402	82,336	19,412	70,358	7,031	42,720
Totals	244,660	339,548	46,283	182,617	15,817	105,592
Mountain States						
Montana	76	1,692	4,746	5,948	844	3,828
Idaho	112	1,330	1,956	4,921	969	5,328
Wyoming	38	3,552	763	3,150	29	2,600
Colorado	1,276	38,970	3,080	6,045	531	12,298
New Mexico	677	3,598	343	714	24	180
Arizona	205	496	43	300	458	320
Utah	250	496	1,436	1,840	252	1,806
Nevada	15	46	151	105	224	240
Totals	2,649	50,180	12,518	23,023	3,331	26,600

Sources: U. S. Department of Agriculture (1900) and Statistical Abstract of the United States, 1932.

FIGURE 1
Production Possibility Frontiers



REGION A



REGION B